

Electromagnetic Flowmeter Converter User Manual

(Process Control Type)

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1 Introduction

According to characteristics of automatic manufacturing process control and requirements of customers, the company developed a process control electromagnetic flowmeter converter. Learn the experience from well-known foreign company, the whole converter is designed to board structure, simplify the installation process and enhance the reliability. Instead of LCD, the converter applies a handheld device or HART communicator to set parameters, do commission and calibration and the operation is compatible with the original product. By inheriting the advantages of the electromagnetic transducer and integrated design features learned from foreign electromagnetic transducer, the performance and reliability of the converter is improved.

Compatibility: the converter is compatible with all converters produced by the company and also compatible with HART Bus.

2 Converter Function Introduction

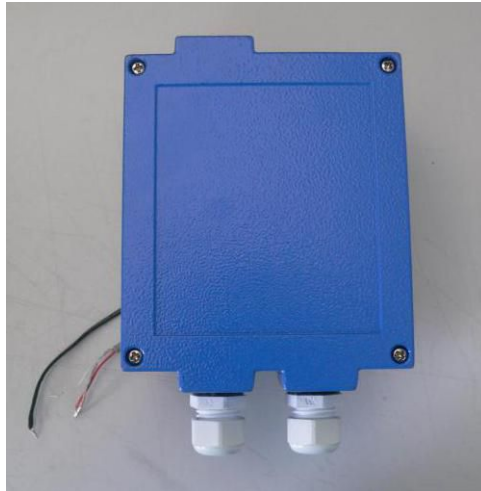
2.1 Basic Function

- Low frequency square wave excitation, excitation frequency: 1/8 power frequency
- Empty pipe measurement function with no additional electrode, continuous measurement, and value alarming
- Flow rate measuring range: 0.1 -15 m/s; flow rate resolution: 0.5 mm/ sec
- Handheld device: mini LCD handheld

2.2 Special Function

- Be compatible with HART handheld, can operate the converter in remote distance.
- Network function: HART Network (Optional)

2.3 Image



Converter



Handheld Device

2.4 Working Environment

Working temperature: -20°C ~ $+60^{\circ}\text{C}$;

Relative humidity: 5%~90%;

Power supply: 220V -- Voltage range: 187~250V, 45~63Hz;

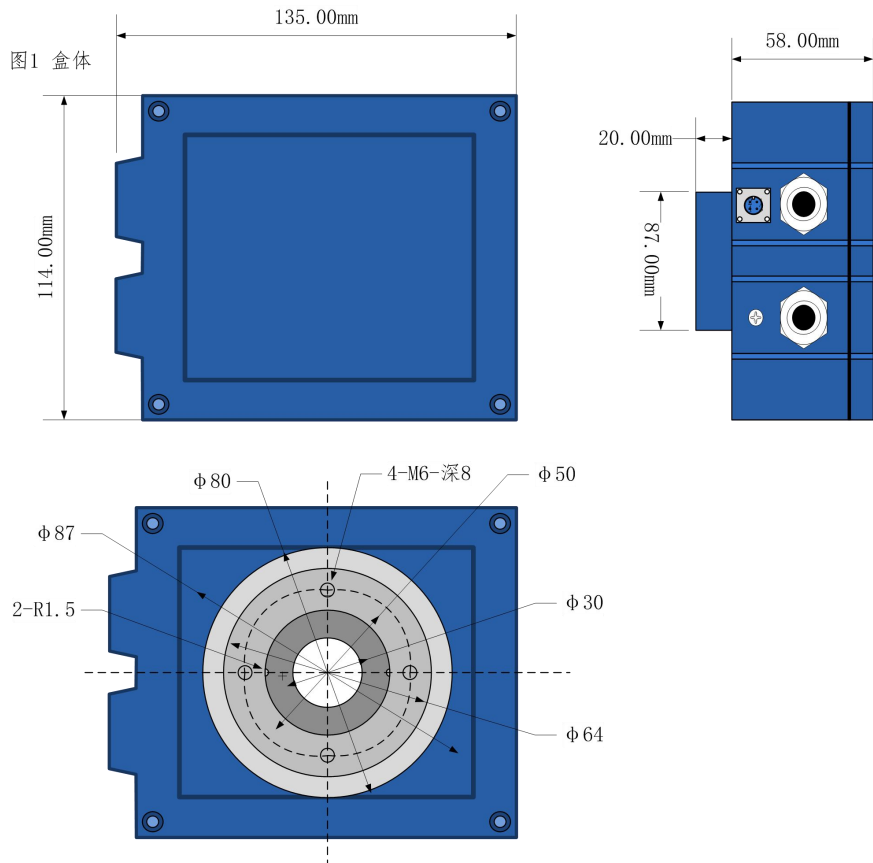
24V -- Voltage range: 16VDC -- 36VDC;

Power Dissipation: less than 5W (after connected to sensor)

2.5 Sensor Connection

Square housing connects with sensor flange.

2.6 Mounting Dimensions



3 Technical Performance Indicator

3.1 Basic parameter and performance indicator

3.1.1 Supporting sensor nominal diameter (mm):

6, 10, 15, 20, 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1200, 1400;

3.1.2 Sensor requirement

Sensor excitation coil resistance: 40~80Ω;

Flow sensor sensitivity: when the flow rate is under 1m/s, the signal is 60~120uV.

3.1.3 Accuracy and range set (m/s)

Table 3.1

Diameter(mm)	Range(m/s)	Accuracy
6~20	Under 0.3	±0.5%FS
	0.3~1	±1.0%R
	1~15	±0.5%R
25~600	0.1~0.3	±0.5%FS
	0.3~1	±0.5%R
	1~15	±0.3%R
700~1400	Under 0.3	±0.5%FS
	0.3~1	±1.0%R
	1~15	±0.5%R
%FS: Relative to range; %R: Relative to measured value		

3.1.4 Analog current output

Load resistance: when 4~20mA, 0~500Ω。

Basic error: 0.1%±10μA。

3.1.5 Digital frequency output

Output frequency range: 1 ~ 5000Hz;

Output electrical isolation: Optical isolation. Isolation voltage :> 1000VDC;

Frequency output drivers: Maximum load current 100mA, maximum load voltage: 36VDC.

3.1.6 Digital pulse output

Output pulse range: 0 -- 100 pulses/sec (higher than the upper limit will lost the pulse);

Output Pulse equivalent: 0.001 ~ 1.000 m3 / cp; 0.001 ~ 1.000 Ltr / cp;

Output pulse width: set by user software;

Output electrical isolation: optical isolation, isolation voltage :> 1000VDC;

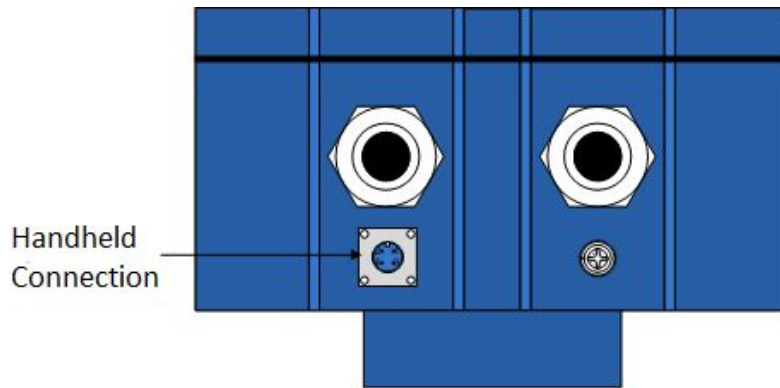
Pulse output driver: FET output, the maximum load voltage is 36VDC, maximum load current is 100mA.

4 Process Control Converter Wiring and Operating

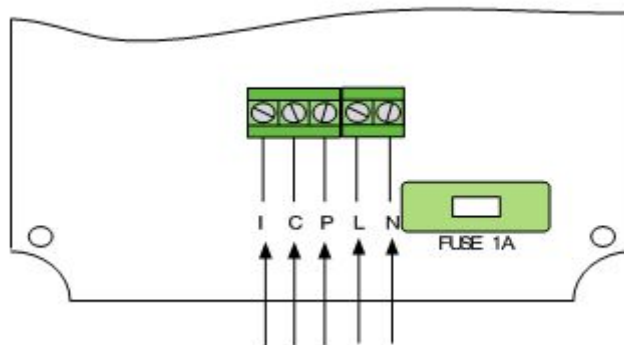
Instructions

4.1 Wiring

4.1.1 Handhold Device Connection



4.1.2 Terminal Wiring



I	Current output
C	Frequency (pulse) / current output grounding
P	Frequency (pulse) output
L	220V power supply input (24VDC+)
N	220V power supply input (24VDC-)

4.2 Converter Operation

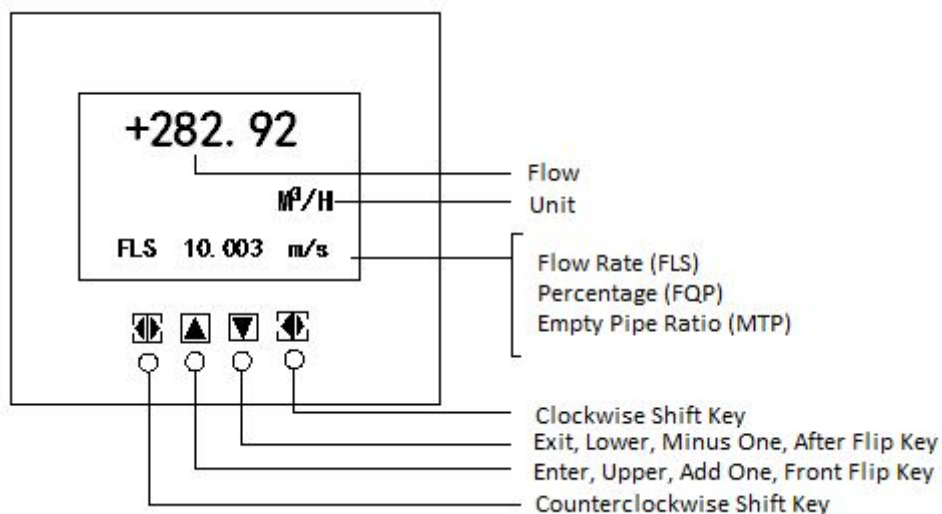
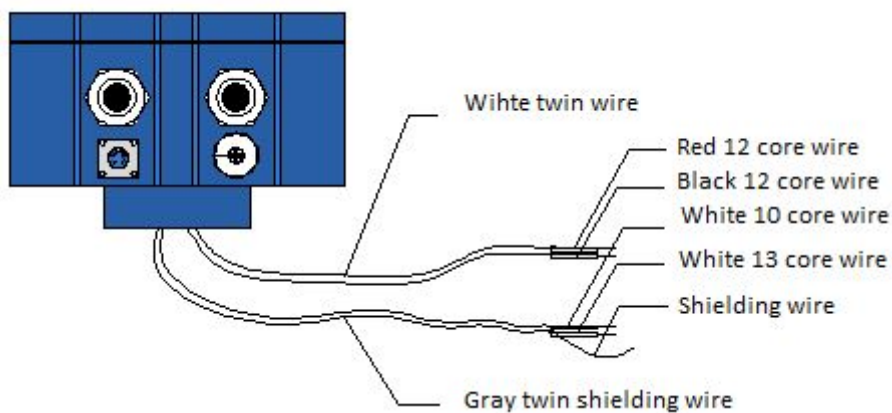


Fig.4.2.1 Keyboard Definition and LCD Definition

Note: Press counterclockwise shift key, enter meter version number displays screen. Press clockwise shift key, meter goes into the function selection screen "Parameter setting", then press Shift to move the cursor to Enter, press Enter to enter the password "00000" state. Enter the password (no password can now enter), press the shift key to move the cursor to Enter, press Enter to enter the selection operation menu to set parameters. If you want to return to running, move the cursor to Exit, press Exit to return.

4.3 Converter Connection to Sensor



Signal wires are as below:

White twin wire: red 12 core wire
black 12 core wire } Connect to exciting current

Gray twin shielding wire: red 10 core wire connects to "signal 1"
white 12 core wire connects to "signal 2"
shielding wire connects to "grounding"

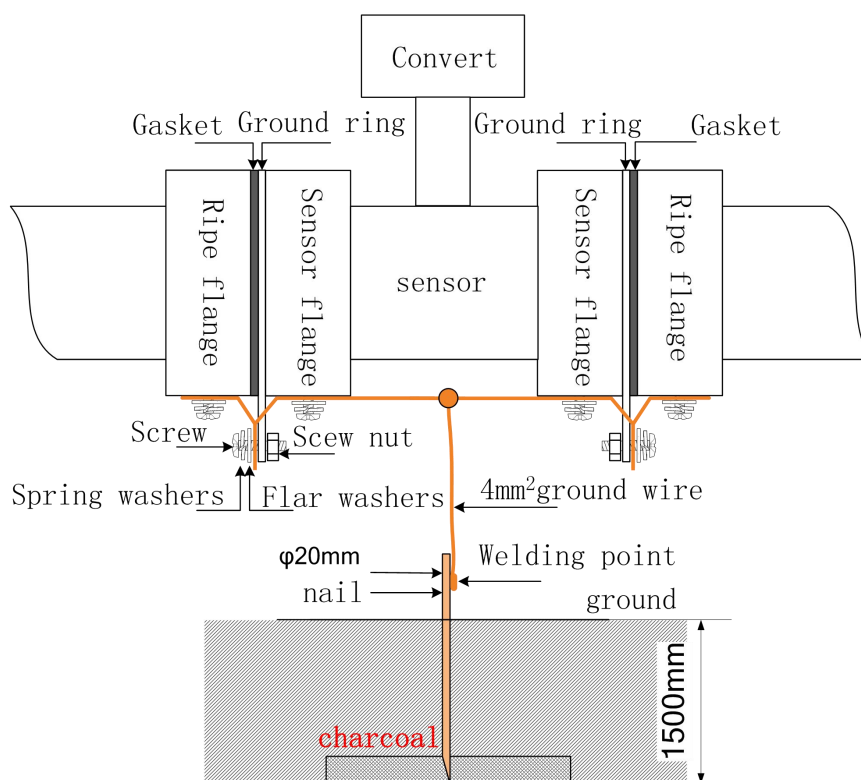
4.4 Converter Installation Grounding Requirements

Converter housing grounding terminal PE shall not be less than 1.6mm² copper grounding wire to connect to the earth ground. The resistance between the converter housing and earth ground shall be less than 10Ω.

First, use $\Phi 20$ copper, cut to 1700mm long (can be extended if necessary) to make ground nail buried 1500mm (Note: When buried nails, nail tips in spreading a layer of wood chips carbon, then pour brine);

Second, solder 4mm² copper wire to the ground nail, and finally ground to the sensor flange, grounding rings, pipe flanges, refer to Fig. 4.3.

Note: stainless steel is required to fixed ground screw, spring washer, and flat washer.



5 Parameter Setting

5.1 Parameter Overview Table

No.	Parameter	Mode	Parameter Range	Secrecy
1	Snsr Size	Select	6~1400	1
2	Flow Unit	Select	L/h、L/m、L/s、m ³ /h、m ³ /m、m ³ /s	1
3	Flow Range	Set	0~99999	1
4	Flow Rspns	Select	1~8s	1
5	Flow Cutoff	Set	0~1.000m/s	1
6	Output Type	Select	Current/Frequency/Impulse	1
7	Freque Max	Select	1~ 5999 Hz	1
8	Mtsnsr Ena	Select	Allowance/Forbidden	1
9	Mtsnsr Trip	Set	599.99 %	1
10	Field Type	Select	Mode 1, 2, 3	1
11	Sensor Fact	Set	0.0000~3.9999	1
12	Flow Zero	Set	0~±9999	1
13	Meter Fact	Set	0.0000~5.9999	1
14	Analog Zero	Set	0.0000~1.9999	1
15	Anlg Range	Set	0.0000~3.9999	1
16	Pulse Fact	Select	0.001L~1 m ³	1
17	Pulse Width	Select	0.5~100ms	1
18	Line CRC Ena	Select	Allowance/Forbidden	1
19	Lineary CRC1	Set	Set according to flow rate	1
20	Lineary Fact1	Set	0.0000~1.9999	1
21	Lineary CRC2	Set	Set according to flow rate	1
22	Lineary Fact 2	Set	0.0000~1.9999	1
23	Lineary CRC3	Set	Set according to flow rate	1
24	Lineary Fact 3	Set	0.0000~1.9999	1
25	Lineary CRC4	Set	Set according to flow rate	1
26	Lineary Fact 4	Set	0.0000~1.9999	1
27	Current CRC	Set	0~100%	1

5.2 Parameter Introduction

5.2.1 Measuring Pipe Size

Sensor pipe size scope is 6 to 1400 mm.

5.2.2 Flow Unit

The Flow Unit can select to L/h, L/m, L/s, m³/h, m³/m and m³/s. Users can select a suitable flow display unit according to process requirements and habits.

5.2.3 Range Setting

Flow range setting means upper limit flow value setting, and lower limit flow value is set "0" automatically.

The range setting determines the range of the meter, and also determines the correspondence between meter percentage display, frequency output, current output and flow:

meter percentage display = (measured flow / meter range) * 100%

meter frequency output = (measured flow / meter range) * frequency full scale

meter current output = (measured flow / meter range) * current full scale + starting point

5.2.4 Measured Damping Time

Long measured damping time can enhance the stability of flow display and output digital, and is applicable for cumulative add up of pulse flow. Short measured damping time means quick respond to measurement, and always apply in production control. Measured damping time setting can be selected

5.2.5 Small Signal Elimination Point

Small signal elimination point setting is showed by flow rate. When applied small signal elimination, the flow, flow rate, percentage display and signal output can also be eliminated.

5.2.6 Output Option

When selecting current output, the meter output signal is 4 ~ 20mA. When selecting frequency output, the meter output signal is 0 ~ 5000Hz. When selecting pulse output, the meter output is pulse signal. Note that the three signal output can not use together and the output mode can only be changed by re-power the meter.

5.2.7 Frequency Output Range

Meter frequency output range corresponds to the flow measurement upper limit, which means 100% of flow percentage. The upper limit of the output frequency can be set within the range of 1 ~ 5000Hz.

5.2.8 Empty Pipe Alarming Allowance

Process control converter has the function of empty pipe detection without additional electrode. If the user chooses to allow empty pipe alarming, when the fluid in the pipe is below the measuring electrode, the meter can detect an

empty pipe condition. After the detection of an empty pipe condition, the meter analog output and digital output will be set to be zero, and the meter display flow will be zero.

5.2.9 Empty Pipe Alarming Threshold

In case the fluid is full filled the pipe (with or without the flow rate), the empty pipe alarming is modified, which is easier to use. The upper line displays the measured conductivity of empty pipe alarming parameter, and the lower line displays the empty pipe alarming threshold. The empty pipe alarming threshold can be set according to the measured conductivity, and it can set to be 3 to 5 times of the measured conductivity.

5.2.10 Excitation Mode Selection

Process control electromagnetic transducer excitation frequency is currently available to select only 1/8 power frequency (mode 1).

5.2.11 Flow Zero-point Correction

Make sure the senior is full and the fluid is in stationary state when doing the flow zero-point correction. Flow zero-point is shown as velocity of flow, mm/s. Zero-point correction displayed as below:

FS = ○ ○ ○ ○ ○
± ○ ○ ○ ○ ○

Upper small characters: FS means measured zero-point

Lower big characters: ZR means corrected flow zero-point

When FS display is not "0", do correction to make FS display to "0". Note: if correct lower line character and FS increases, change the "+, -" in lower line to make sure FS display to be zero.

The corrected flow zero-point is the compound value of sensor, and shall be recorded in sensor list and label. The unit is mm/s, and the sign is in opposite with corrected value.

5.2.12 Sensor Coefficient Value

The coefficient is electromagnetic flow meter calibration coefficient. The coefficient is obtained from the actual calibration, and stenciled onto the sensor plate. This coefficient must be placed in the parameter table of process control converter.

5.2.13 Factory Calibration Coefficient

The coefficient is specially used by converter manufacturer to normalize measurement circuit of process control electromagnetic converter to ensure that 0.1% interchangeability all types of process control electromagnetic converters.

5.2.14 Current Zero-point Correction

The current zero-point correction of the converter when it leaves the factory,

and current converter output zero adjustment to make the current output accurately as 0mA or 4mA.

5.2.15 Current Full-scale Correction

The current full-scale t correction of the converter when it leaves the factory, and current converter output zero adjustment to make the current output accurately as 10mA or 20mA.

5.2.16 Pulse Unit Equivalent

0.001L, 0.010L, 0.100L, 1.000L, 0.001m³, 0.010m³, 0.100m³, 1.000m³

5.2.17 Pulse Unit Width

Pulse output is active-low pulse width is 0.5 ~ 100mS

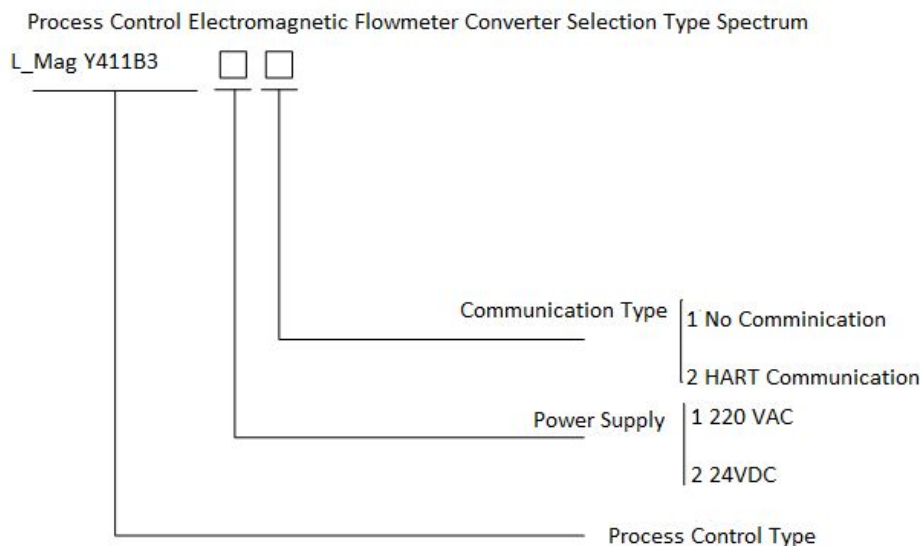
Table: Pulse width - Maximum output pulse number corresponding table

Number	Pulse width (ms)	Maximum output pulse number per hour(p/h)
1	100	9000
2	80	11250
3	40	22500
4	20	45000
5	10	90000
6	8	112500
7	4	225000
8	2	450000
9	1	900000
10	0.8	1125000

5.2.18 Output Current Test

When use the parameter, user can test 4 ~ 20mA output signal on line.

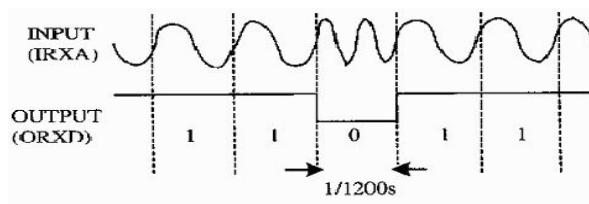
6 Selection Type Spectrum



Annex 1 HART Communication Introduction

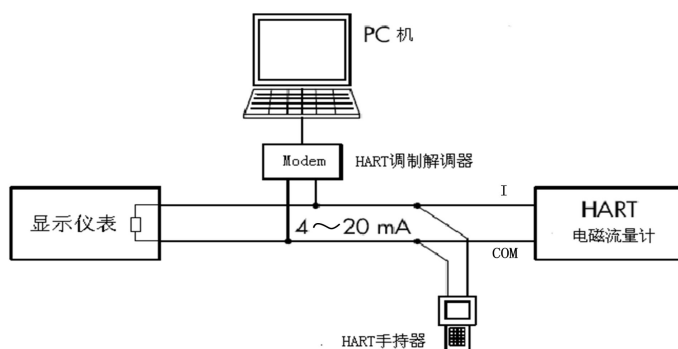
1 HART Bus Introduction

HART bus was developed by Rosemount in 1993, and can be applied to field device data communication. HART is the abbreviation of "Highway Addressable Remote Transducer", which means "Addressable Remote Transducer data path". Its data signal transmission method is superimposed an FM signal on 4-20mA current signal. Logic "1" signal is represented by 1200Hz signal, logic "0" is represented by 2200Hz signal and baud rate of 1200bps. Its signal modulation waveform is shown as below.



2 HART bus on-site network

The characteristic of HART bus is use 4-20mA signal lines to transmit data signals, which can save data communication lines and achieve data communication in the field. HART bus on-site network is shown as below:



3 Cautions

- 1) Handheld and HARTMODEM in parallel across the load of electromagnetic flow meter current output has no polarity.
- 2) The resistance of the loop shall be larger than 200Ω and less than 500Ω.
- 3) Handheld devices, HARTMODEM shall not string into the current loop.

Annex2 Nonlinear Correction

Nonlinear correction function is applied when the flow is below 0.3m/s. The function has 4 correction phases, which contain 4 correction points and 4 correction parameters.

Nonlinear correction is based on the original sensor calibration coefficient correction, therefore, nonlinear correction function shall be closed to mark sensor coefficient, and then apply the function to do nonlinear correction. The correction point and correction coefficient can be set according to sensor nonlinear phase, and if the setting is appropriate, there is no need to do the recalibration.

The flow rate through the sensor coefficient calculated is **original flow rate**, and the flow rate by non-linear correction is **corrected flow rate**, the **corrected flow rate** has the following correspondence;

If Correction point 1 > Original Flow Rate \geq Correction point 2;

Corrected Flow Rate = Correction Coefficient 1 \times Original Flow Rate;

If Correction point 2 > Original Flow Rate \geq Correction point 3;

Corrected Flow Rate = Correction Coefficient 2 \times Original Flow Rate;

If Correction point 3 > Original Flow Rate \geq Correction point 4;

Corrected Flow Rate = Correction Coefficient 3 \times Original Flow Rate;

If Correction point 4 > Original Flow Rate ≥ 0 ;

Corrected Flow Rate = Correction Coefficient 4 \times Original Flow Rate;

Note: When setting the Correction point, make sure

Correction point1 > Correction point2 > Correction point3 > Correction point4 > 0

The middle of correction coefficient is 1.0000, if the coefficient is larger than 1, the correction is positive (increase); otherwise, the correction is negative (decrease).